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NAME OF INVENTOR(S): Koe	
RECEIPT DATE & SERIAL NO.: <b>Serial No.: 10/766,233</b> <b>Patent No.: 6,940,438</b> Filing Date: 1/28/2004	
TITLE OF INVENTION: METHOD AND CIRCUIT FOR REDUCING QUANTIZER INPUT/OUTPUT SWING IN A SIGMA-DELTA MODULATOR	
TI FILE NO.: <b>TI-36585</b>	DEPOSIT ACCT. NO.: <b>20-0668</b>
FAXED: 09/09/2005 DUE: ATTY/SECY: wds@ic	

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Applicant: Koe, et al.

Art Unit: 2819

Serial No.: 10/766,233

Examiner: Mai, Lam T.

Filing Date: 1/28/2004

Docket No.: TI-36585

Patent No.: 6,940,438

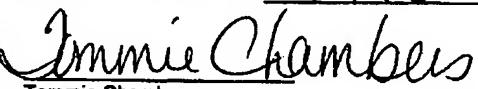
Issue Date: 9/6/2005

Title: METHOD AND CIRCUIT FOR REDUCING QUANTIZER INPUT/OUTPUT SWING IN A SIGMA-DELTA MODULATOR

LETTER OF TRANSMITTAL

Assistant Commissioner for  
Patents  
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Sir:

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 Tommie Chambers	

Enclosed is a Certificate of Correction for U.S. Patent No. 6,578,123.

Applicants believe that the error is the responsibility of the United States Patent and Trademark Office, therefore do fees are due at this time.

Respectfully submitted,

  
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## UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

PATENT NO: 6,940,438

DATED: 09/06/2005

INVENTOR(S): Wern Ming Koe, Franco Maloberti, and James Robert Hochschild

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Inventors: Wern Ming Koe, Dallas, TX (US)  
Franco Maloberti, Plano, TX (US)  
James Robert Hochschild, Plano, TX (US)

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PATENT NO. 6,940,438

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(12) United States Patent  
Koe et al.

(10) Patent No.: US 6,940,438 B2  
(45) Date of Patent: Sep. 6, 2005

(54) METHOD AND CIRCUIT FOR REDUCING QUANTIZER INPUT/OUTPUT SWING IN A SIGMA-DELTA MODULATOR

(75) Inventors: *Wen Ming Koe, Dallas, TX (US); Franco Maloberti, Plano, TX (US); James Robert Hochschild, Plano, TX (US)*

(73) Assignee: Texas Instruments Incorporated, Dallas, TX (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 10/766,233

(22) Filed: Jan. 28, 2004

(65) Prior Publication Data

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(51) Int. Cl.<sup>7</sup> ..... H03M 3/00

(52) U.S. Cl. ..... 341/143; 341/156; 341/176

(58) Field of Search ..... 341/143, 144, 341/156, 155, 176, 131

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Primary Examiner—Lam T. Mai

(74) Attorney, Agent, or Firm—W. Daniel Swayze, Jr.; W. James Brady; Frederick J. Telecky, Jr.

(57) ABSTRACT

Disclosed is a circuit and method for reducing output swing in a sigma delta modulator. The quantizer output swing reduction circuit and method of the present invention advantageously enables the modulator to have a larger input/output swing range without degrading the SNR and SFDR performance. One embodiment of the present invention comprises a conventional sigma-delta modulation circuit (100) and a quantizer swing reduction block (210). The quantizer swing reduction block (210) comprises an input signal  $V_x$  (216), a signal processing block (214) with transfer function  $H_3$  and another signal processing block (215) with transfer function  $H_2 \cdot H_3$ .

32 Claims, 11 Drawing Sheets

